

The Motor Effect

Question Paper

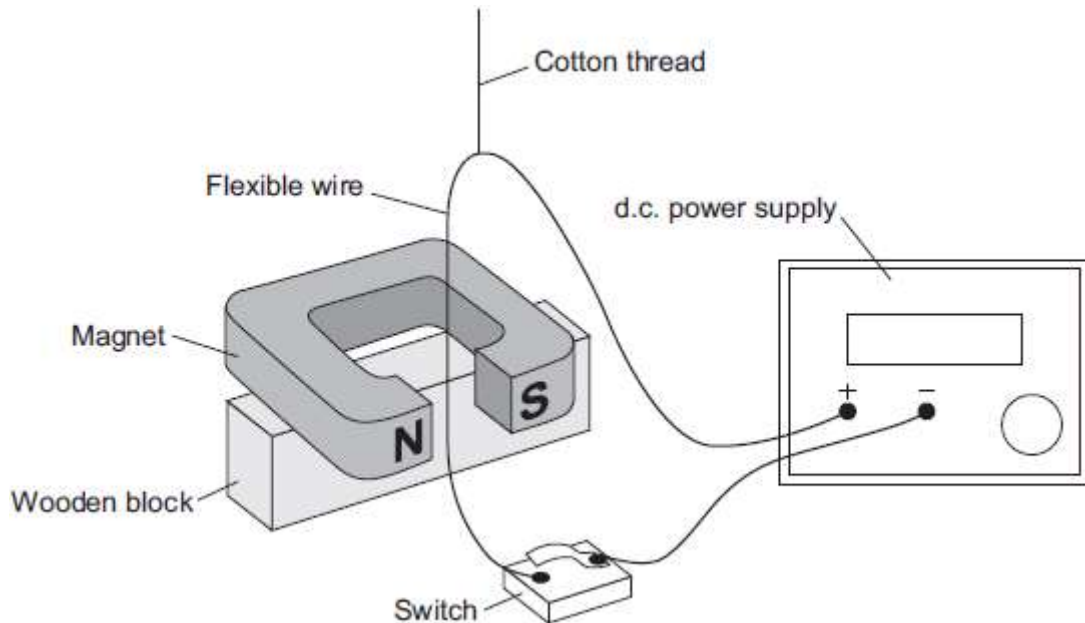
Level	GCSE
Subject	Physics
Exam Board	AQA
Unit	P3
Topic	The Motor Effect
Difficulty Level	Bronze Level
Booklet	Question Paper

Time Allowed: 58 minutes

Score: /58

Percentage: /100

Q1. The diagram shows a demonstration carried out by a teacher.



When the switch is closed, there is a current of 2 A through the wire. The wire experiences a force and moves.

(a) Use the correct word from the box to complete the sentence.

generator	motor	transformer
-----------	-------	-------------

The demonstration shows the effect.

(1)

(b) State **two** changes that the teacher could make to the demonstration, each of which would increase the force on the wire. The teacher does not touch the wire.

- 1.....
-
- 2.....
-

(2)

- (c) State **one** change that the teacher could make to the demonstration to change the direction of the force on the wire.

.....
.....

(1)

- (d) With the switch closed, the teacher changes the position of the wire so that the force on the wire is zero.

What is the position of the wire?

Tick (✓) **one** box.

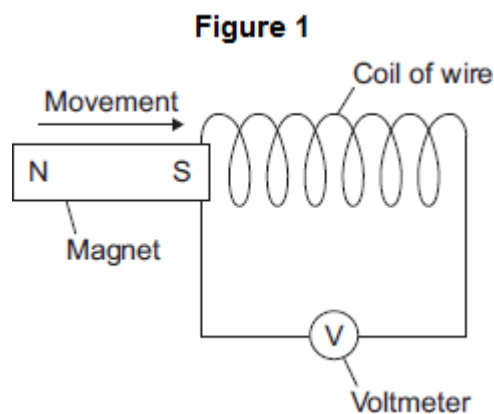
The wire is at 90° to the direction of the magnetic field.

The wire is at 45° to the direction of the magnetic field.

The wire is parallel to the direction of the magnetic field.

(1)
(Total 5 marks)

Q2.Figure 1 shows a magnet moving into a coil of wire. This movement causes a reading on the voltmeter.



- (a) Use the correct word from the box to complete the sentence.

generated	induced	produced
-----------	---------	----------

Moving the magnet into the coil of wire causes a reading on the voltmeter

because a potential difference is across the ends of the wire.

(1)

- (b) A student investigated how the number of turns on the coil of wire affects the maximum voltmeter reading. The student changed the number of turns on the coil of wire, then moved the magnet into the coil. The student recorded the maximum voltmeter reading.

To obtain valid data, suggest **two** variables that the student should control in this investigation.

1.....

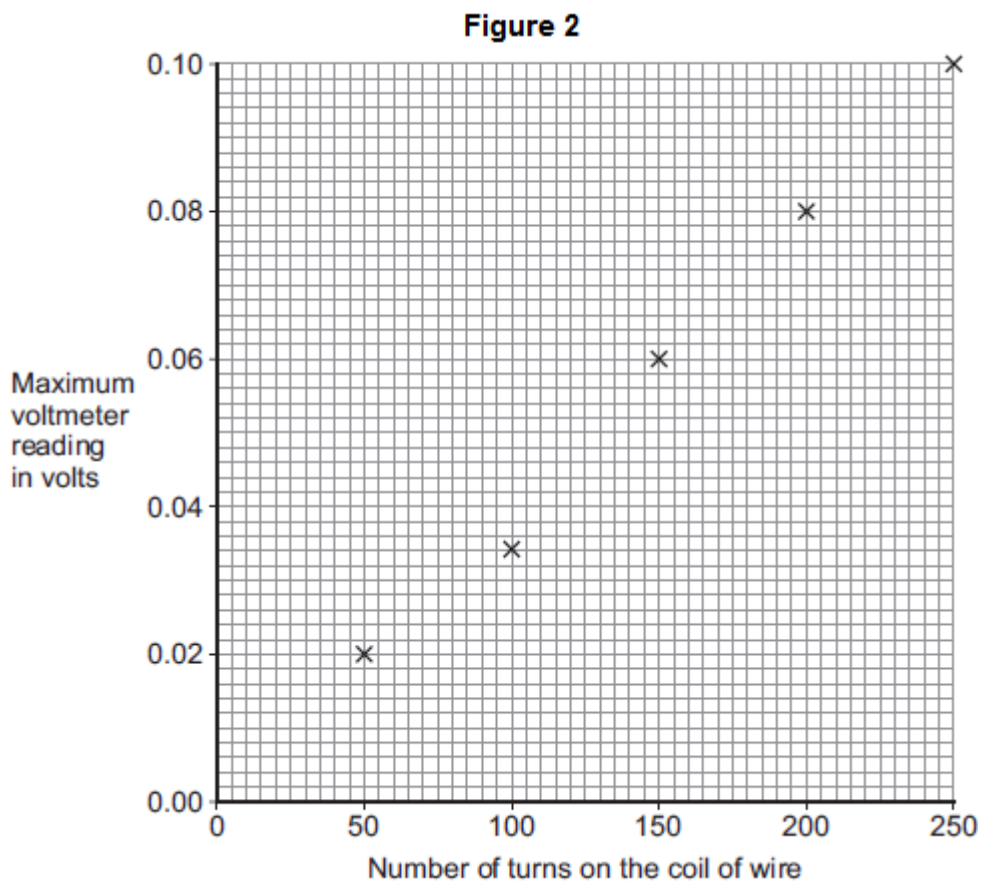
.....

2.....

.....

(2)

- (c) The student's results are shown in **Figure 2**.



- (i) One of the results is anomalous.
Suggest a reason for the anomalous result.

.....

(1)

- (ii) Draw a line of best fit on **Figure 2**.

(1)

- (d) A data-logger can automatically record and store data.

It may have been better for the student to have used a data-logger in his investigation rather than a voltmeter.

Suggest **one** reason why.

.....
.....

(1)

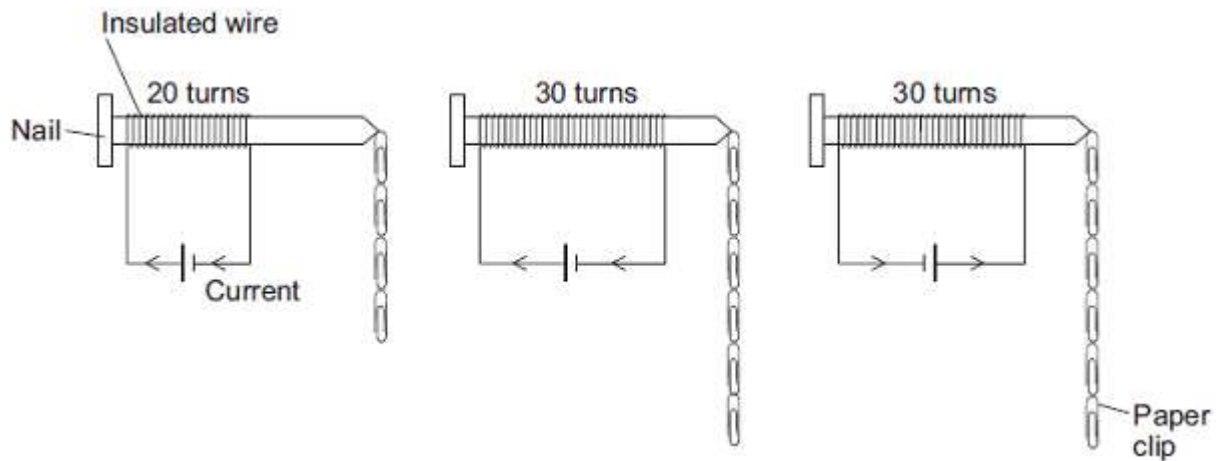
(Total 6 marks)

Q3.A student is investigating the strength of electromagnets.

Figure 1 shows three electromagnets.

The student hung a line of paper clips from each electromagnet.

Figure 1



Electromagnet A

Electromagnet B

Electromagnet C

No more paper clips can be hung from the bottom of each line of paper clips.

(a) (i) Complete the conclusion that the student should make from this investigation.

Increasing the number of turns of wire wrapped around the nail will
.....

the strength of the electromagnet.

(1)

(ii) Which **two** pairs of electromagnets should be compared to make this conclusion?

Pair 1: Electromagnets and

Pair 2: Electromagnets and

(1)

(iii) Suggest **two** variables that the student should control in this investigation.

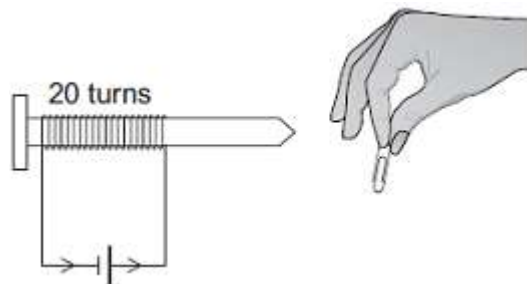
1

2

(2)

- (b) The cell in electromagnet **A** is swapped around to make the current flow in the opposite direction. This is shown in **Figure 2**.

Figure 2



What is the maximum number of paper clips that can now be hung in a line from this electromagnet?

Draw a ring around the correct answer.

fewer than 4

4

more than 4

Give **one** reason for your answer.

.....
.....
.....

(2)

- (c) Electromagnet **A** is changed to have only 10 turns of wire wrapped around the nail.

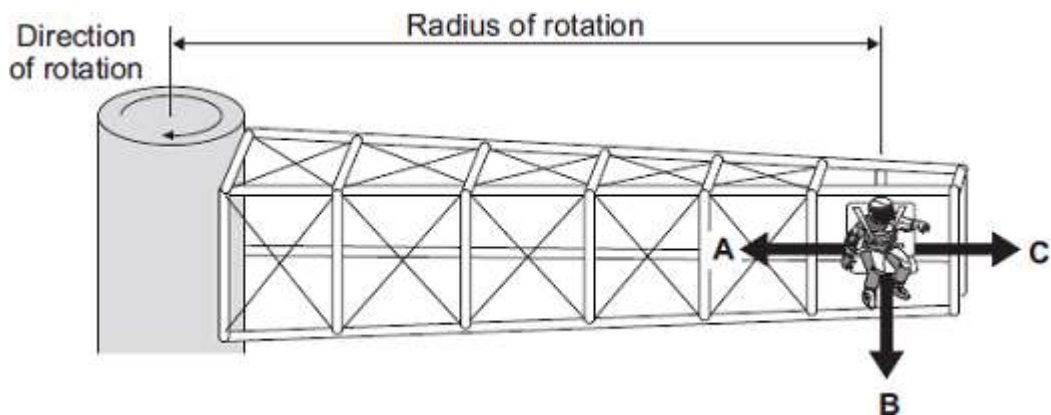
Suggest the maximum number of paper clips that could be hung in a line from the end of this electromagnet.

Maximum number of paper clips =

(1)

(Total 7 marks)

Q4.The diagram shows a 'G-machine'. The G-machine is used in astronaut training.



The G-machine moves the astronaut in a horizontal circle.

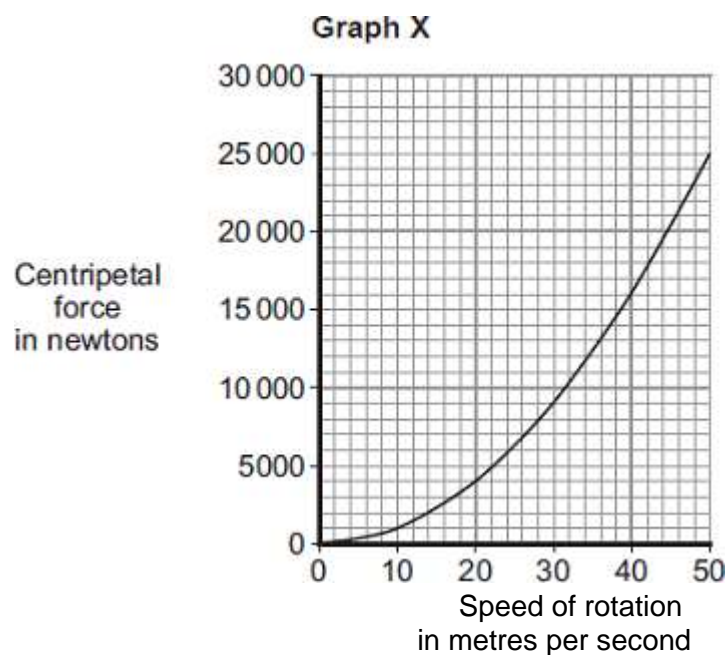
- (a) In which direction, **A**, **B** or **C**, does the centripetal force on the astronaut act?

Write your answer in the box.

(1)

- (b) The centripetal force on the astronaut is measured.

Graph X shows how the centripetal force is affected by the speed of rotation. The radius of rotation is kept the same.



- (i) Use **Graph X** to determine the centripetal force on the astronaut when rotating

at a speed of 30 metres per second.

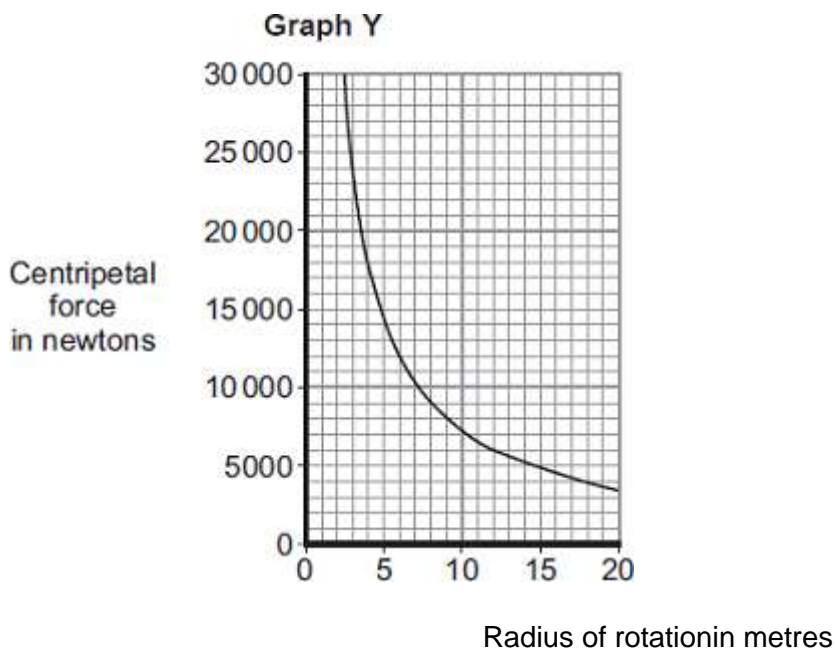
Centripetal force = newtons (1)

- (ii) Complete the following sentence to give the conclusion that can be made from **Graph X**.

Increasing the speed of rotation of a G-machine will

the centripetal force on the astronaut. (1)

- (iii) **Graph Y** shows how the centripetal force is affected by the radius of rotation, when the speed of rotation is kept the same.

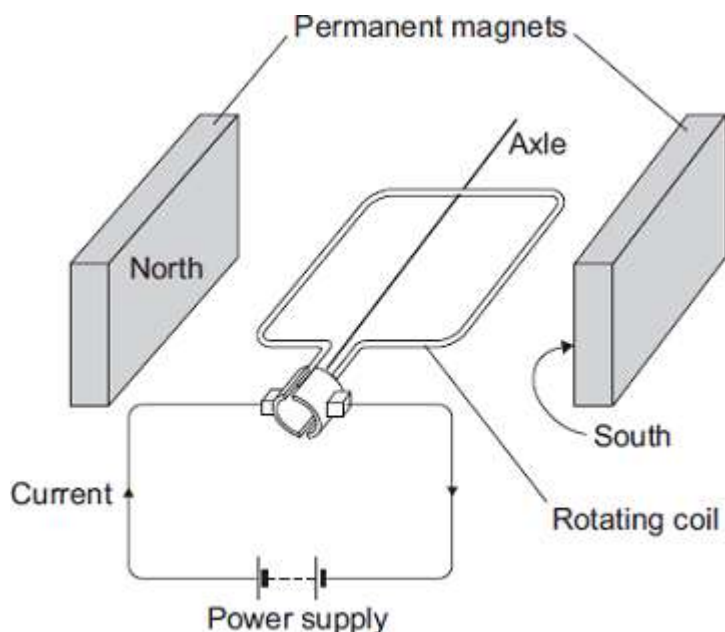


Complete the following sentence to give the conclusion that can be made from **Graph Y**.

The greater the radius of rotation, the the centripetal force

on the astronaut. (1)

- (c) The G-machine is rotated by an electric motor. The diagram shows a simple electric motor.



The following statements explain how the motor creates a turning force. The statements are in the wrong order.

- M** – The magnetic field interacts with the magnetic field of the permanent magnets.
- N** – A magnetic field is created around the coil.
- O** – The power supply applies a potential difference across the coil.
- P** – This creates a force that makes the coil spin.
- Q** – A current flows through the coil.

Arrange the statements in the correct order. Two of them have been done for you.



(2)

- (d) The electric motor produces a turning force.

Give **two** ways of increasing the turning force.

- 1
-
- 2

.....

(2)

- (e) Draw a ring around the correct answer to complete the sentence.

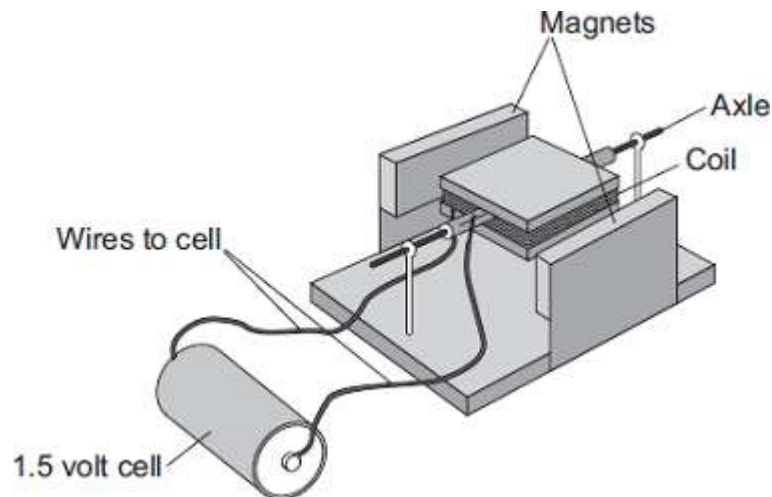
It costs a lot of money to send astronauts into space.

This is

an economic		issue.
an environmental		
a social		

(1)
(Total 9 marks)

Q5.A student has made a simple electric motor. The diagram shows the electric motor.



- (a) Complete the following sentence by drawing a ring around the correct line in the box.

Once the coil is spinning, one side of the coil is pushed by

the cell
the coil
a force

and the other

side is pulled, so the coil continues to spin.

(1)

- (b) Suggest **two** changes to the electric motor, each one of which would make the coil spin faster.

1

.....

2

.....

(2)

- (c) Suggest **two** changes to the electric motor, each one of which would make the coil spin in the opposite direction.

1

.....

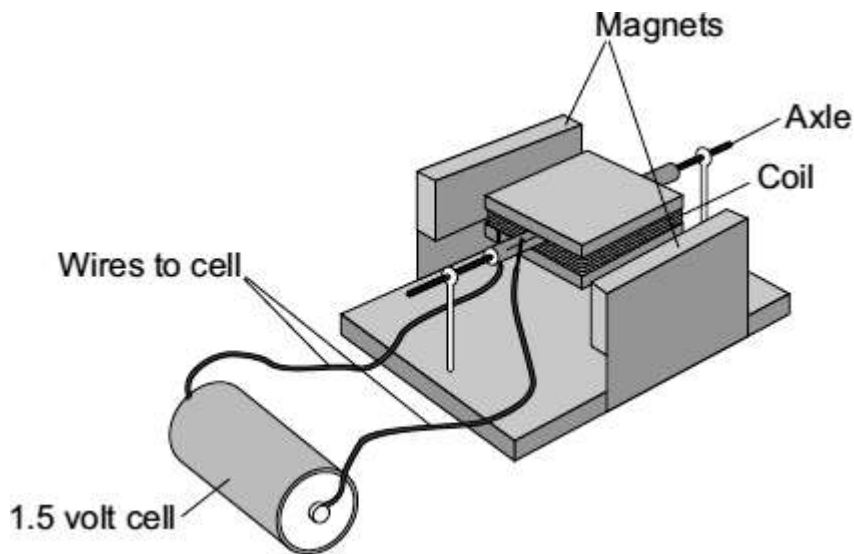
2

.....

(2)

(Total 5 marks)

- Q6.** (a) Complete the description of the device shown below by drawing a ring around the correct line in each box.



(i) The device is being used as

- an electric motor.
- a generator.
- a transformer.

(1)

(ii) The coil needs a flick to get started. Then one side of the coil is pushed by the

cell
coil and the other side is pulled, so that the coil spins.
force

(1)

(b) Suggest **two** changes to the device, each one of which would make the coil spin faster.

- 1
-
- 2
-

(2)

- (c) Suggest **two** changes to the device, each one of which would make the coil spin in the opposite direction.

1

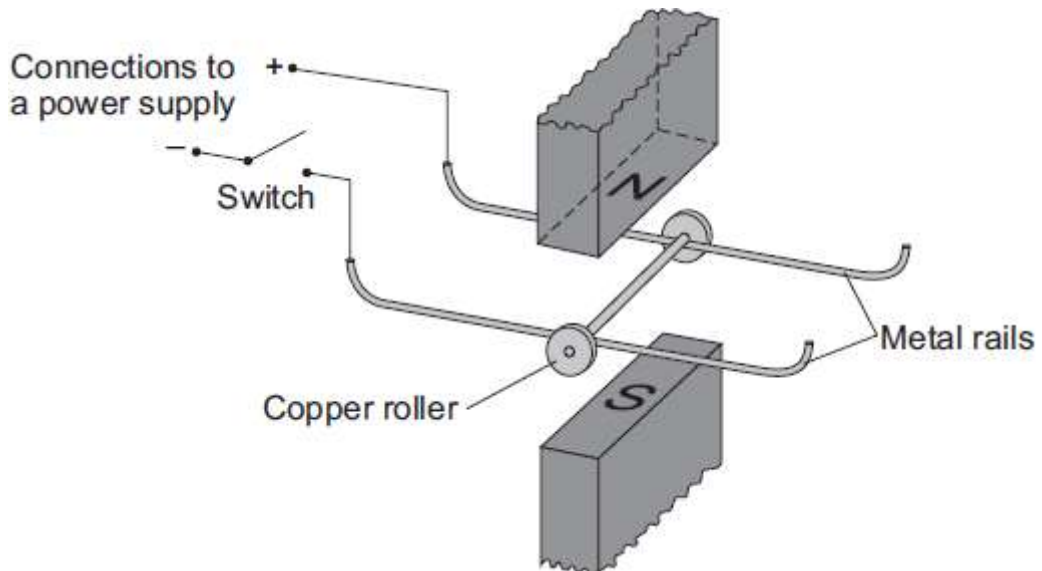
.....

2

.....

(2)
(Total 6 marks)

- Q7.** (a) A science technician sets up the apparatus shown below to demonstrate the motor effect. He uses a powerful permanent magnet.



The copper roller is placed across the metal rails. When the switch is closed, the copper roller moves to the right.

- (i) Complete the sentence by drawing a ring around the correct line in the box.

an electrical conductor.

This happens because copper is

an electrical insulator. a magnetic material.
--

(1)

- (ii) Suggest **one** change that the technician can make which will cause the copper roller to move faster.

.....
.....

(1)

- (iii) Suggest **two** changes which the technician can make, each of which will separately cause the copper roller to move to the left.

1

.....

2

.....

(2)

- (b) Many electrical appliances, such as vacuum cleaners, drills and CD players, contain electric motors. As more electrical appliances are developed, more electricity needs to be generated. Generating electricity often produces pollutant gases.

- (i) Complete the sentence by drawing a ring around the correct line in the box.

Generating more electricity to power the increasing number of electrical appliances used

raises

an ethical
an environmental
a political

 issue.

(1)

- (ii) The number of electrical appliances used in the world's richest countries is increasing yet many people in the world's poorest countries have no access to electricity.

What type of issue does this inequality between people in different countries raise?

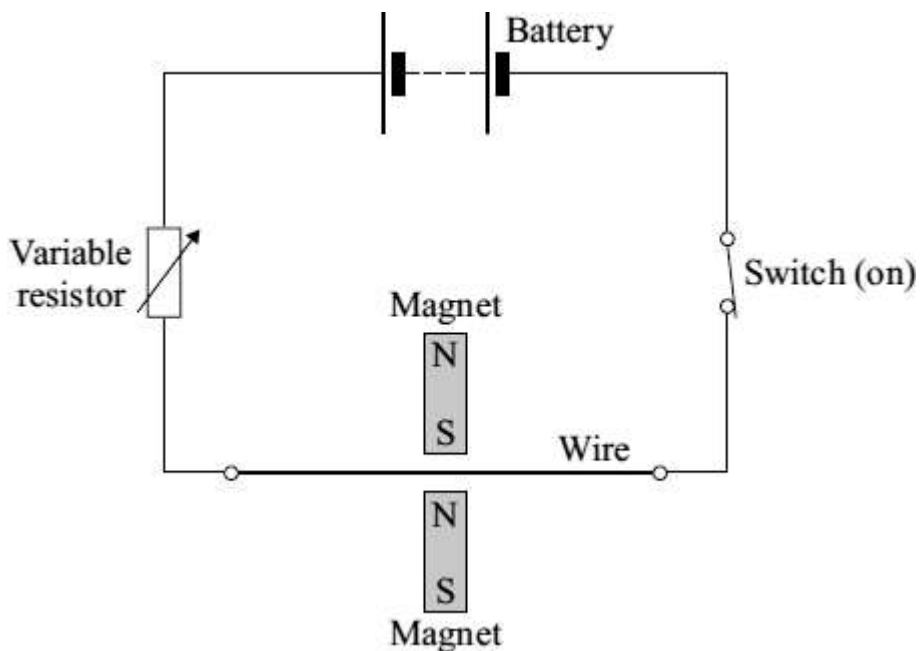
.....

(1)
(Total 6 marks)

- Q8.** A student investigates the electromagnetic force acting on a wire which carries an electric current. The wire is in a magnetic field.

The diagram shows the circuit which the student uses.

- (a) Draw an **X** on the diagram, with the centre of the **X** in the most strongest part of the magnetic field.



(1)

- (b) Give **one** change that she can make to the magnets to **decrease** the electromagnetic force on the wire.

.....
.....

(1)

- (c) The student wants to change the electromagnetic force on the wire without changing the magnets or moving their position.

- (i) Give **one** way in which she can **increase** the electromagnetic force.

.....
.....

(1)

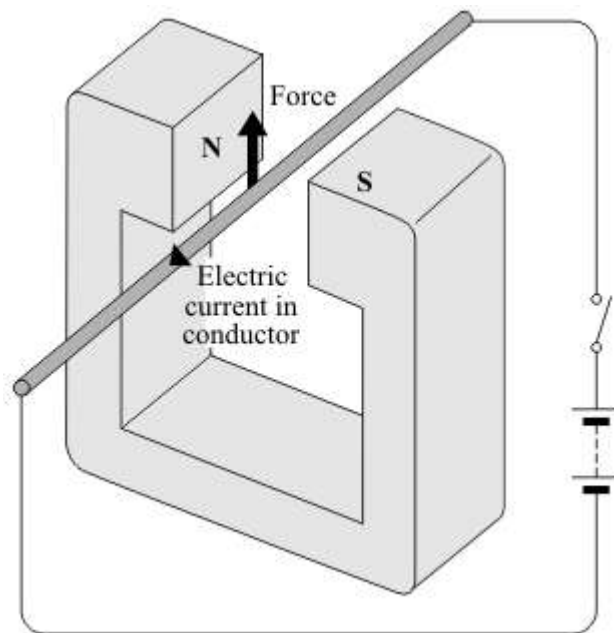
- (ii) Give **one** way in which she can **reverse** the direction of the electromagnetic force.

.....
.....

(1)

(Total 4 marks)

- Q9.** When a conductor carrying an electric current is placed in a magnetic field a force may act on it.



(a) State **two** ways in which this force can be increased.

1

2

(2)

(b) State **two** ways in which this force can be made to act in the opposite direction.

1

2

(2)

(c) In what circumstance will **no** force act on a conductor carrying an electric current and in a magnetic field?

.....

.....

(1)

(Total 5 marks)

Show clearly how you work out your answer.

.....

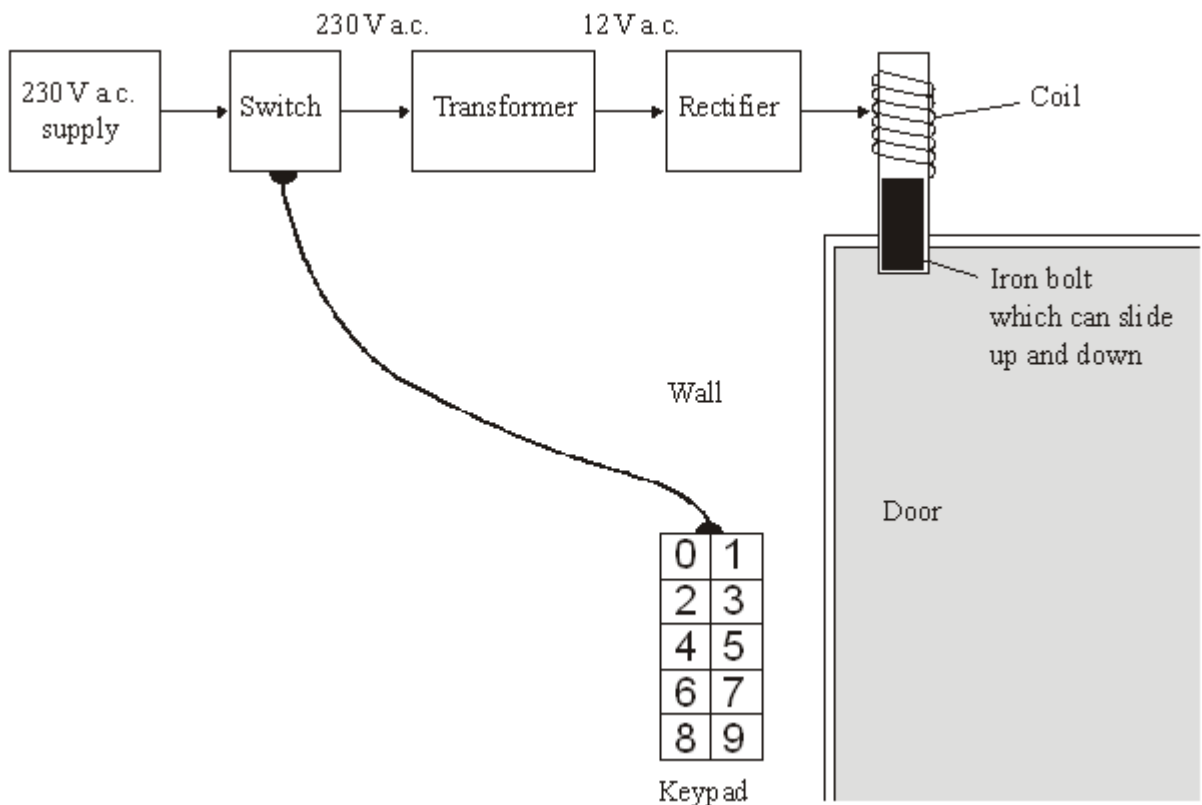
.....

Kinetic energy = J

(2)
(Total 7 marks)

Q10. The diagram shows the design for a remotely controlled door bolt.

When the correct numbers are entered into the keypad the transformer switches on. Then the door can be opened.



(a) What kind of transformer is shown in the diagram?

..... (1)

(b) What does the abbreviation a.c. stand for?

..... (1)

(c) Complete the sentences using the correct words from the box.

attracts	downwards	magnet	reflects	repels
sideways	switch	transformer	upwards	

(i) When a current flows in the coil, the coil becomes a

(ii) The coil the iron bolt which moves

(3)
(Total 5 marks)